Progressive T&E And The Virtual Missile Range

Presented To:

NDIA

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Theme

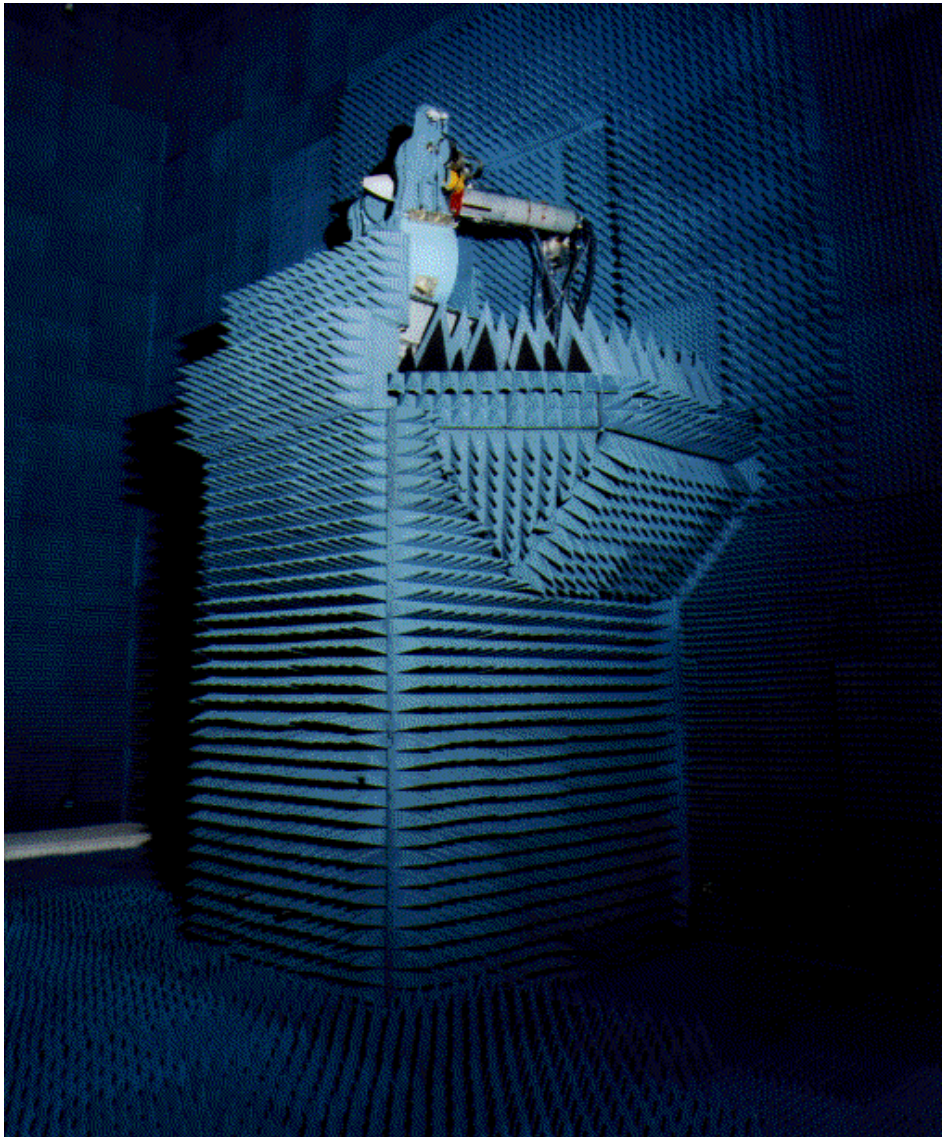
The Virtual Missile Range became a reality because of T&E opportunities

Outline

- T&E Opportunities
- VMR Vision
- Progressive T&E Process
- Implementation & Results

Hardware-In-the-Loop (HIL) Lab(s)

- **Major Components**
  - **Missile guidance system on a 3-axis motion table**
  - **Anechoic chamber with target array**
  - **High performance, real-time computer system**
- **RF Signals Simulate:**
  - **Target skin returns**
  - **Sea clutter**
  - **Sea image**
  - **Electronic Countermeasures**

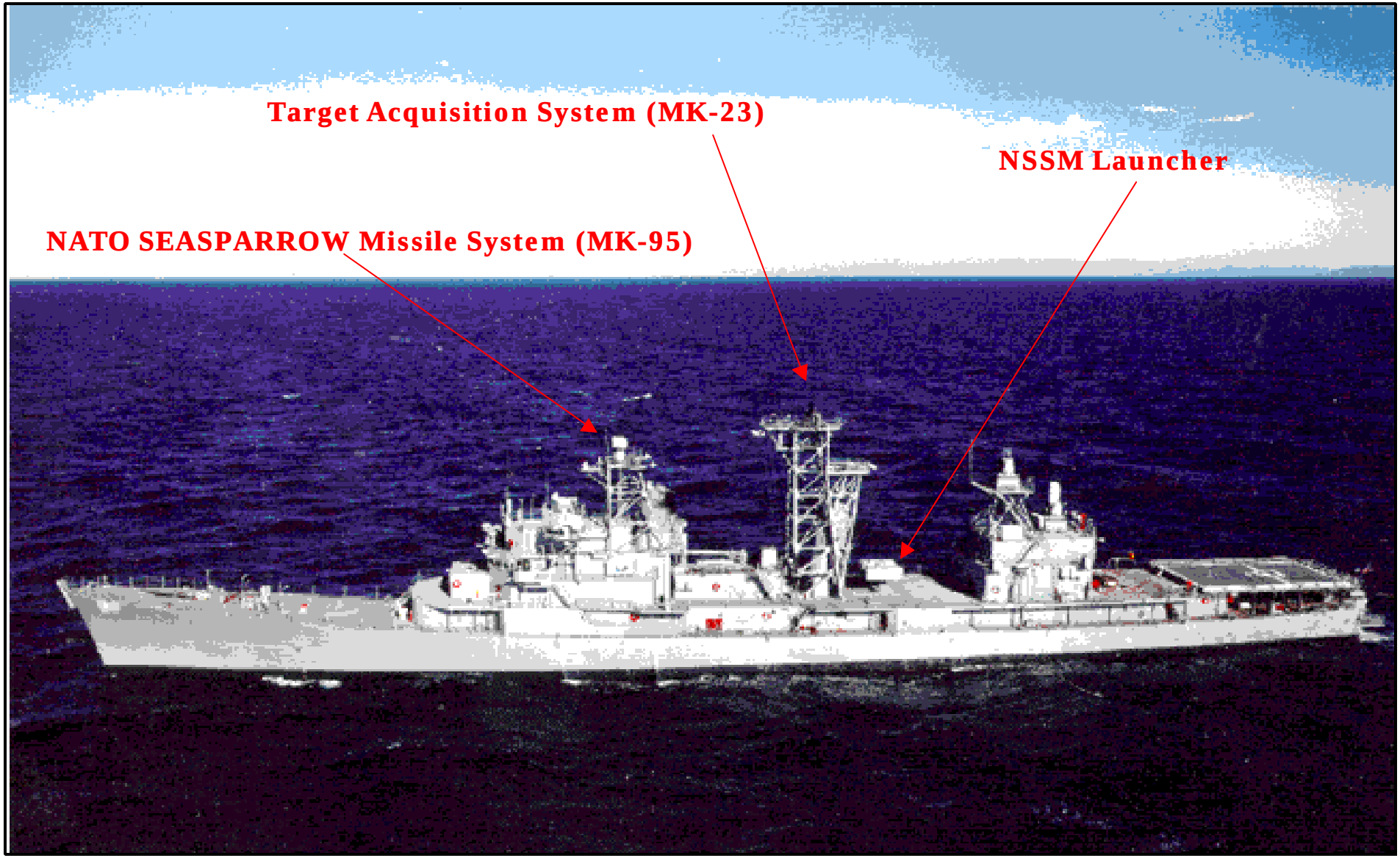


Threat Simulation

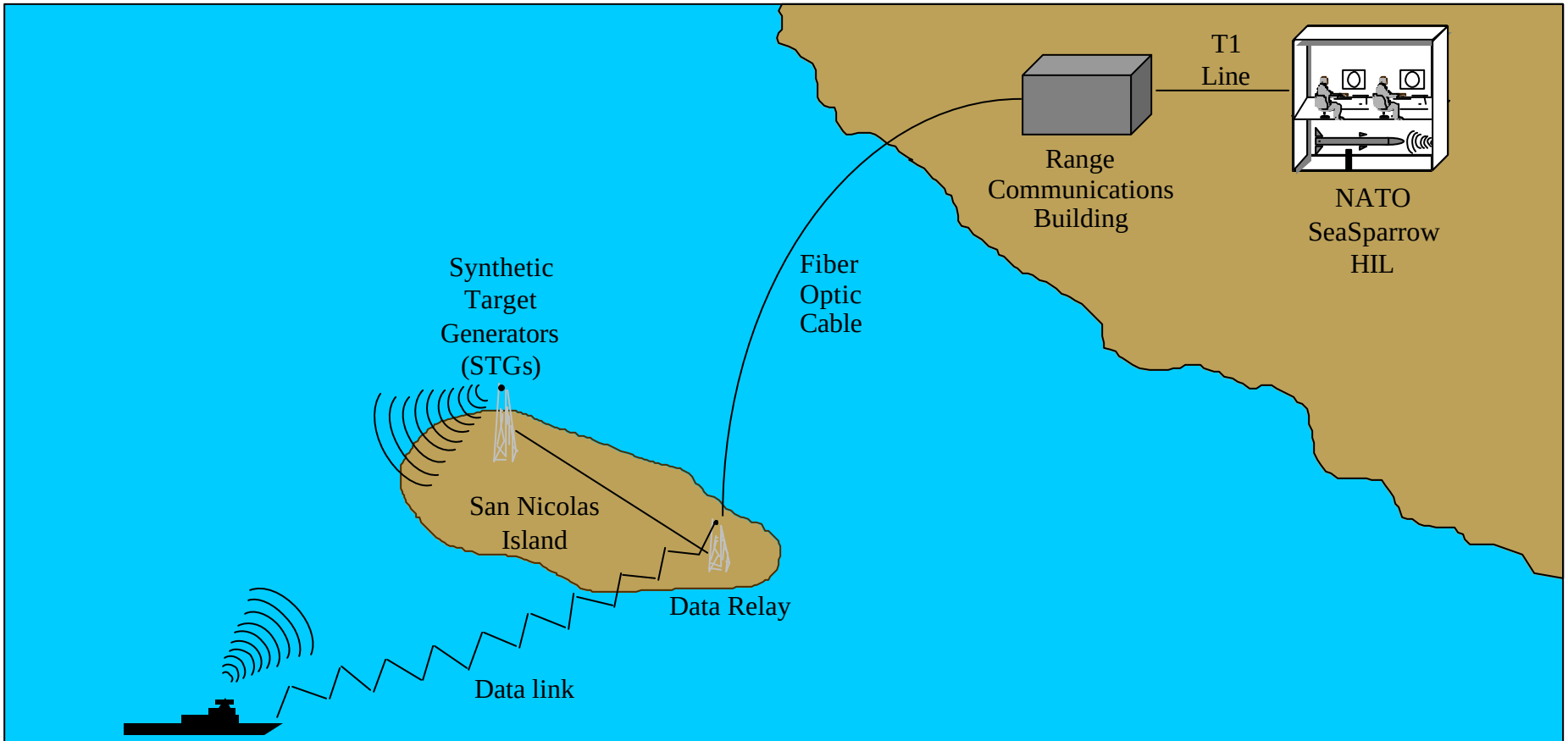
- **Tri-Service Lead**
  - This lead includes all EA and radar signal simulators used in targets
- **Goal**
  - Develop, deploy, and support EW threat simulation equipment that provides realistic threat radar signals and threat electronic attack (EA) signals.

Surface Warfare Engineering Facility

Self Defense Test Ship



Vision & Operational End-State



Ship operating on the NAWCWD range:

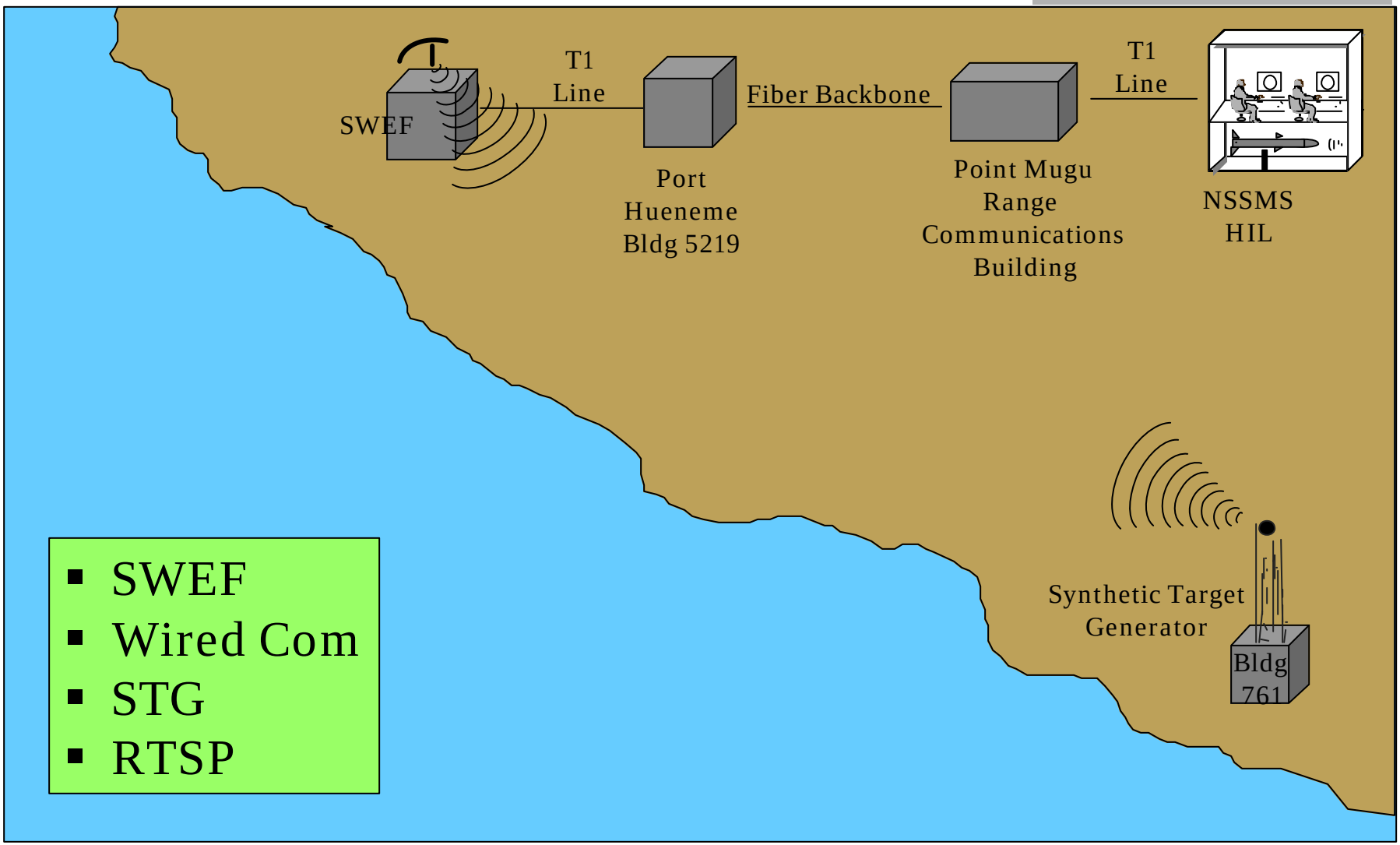
- **STGs stimulate the operational ship's MK-23 Radar and MK-95 Fire-Control Systems, presenting an incoming synthetic threat**
- **Ship initiates it's Missile Launch sequence (weapon is also simulated)**
- **Engagement is played out in the shore-based Hardware-In-the-Loop (HIL) simulation**
- **Engagement results are fed back to the ship**

Program Start

- VMR Program Approved -- February 1999
- VMR Team Identified
- VMR Design, With Specific T&E Phases Scheduled
- Long-lead H/W Contracted
- Real-Time Simulation Protocol (RTSP) Selected
- COTS H/W Investigated And T&Eed

Land-Based T&E, Phase 1

Aug '99 - Oct '99



Land-Based T&E, Phase 2

Passive Taps

Nov '99 - Jan '00

SWEF

T1 Line

Port Hueneme Bldg 5219

Fiber Backbone

Point Mugu Range Communications Building

T1 Line

NSSMS HIL

SMITH Unit

Launcher/MARS

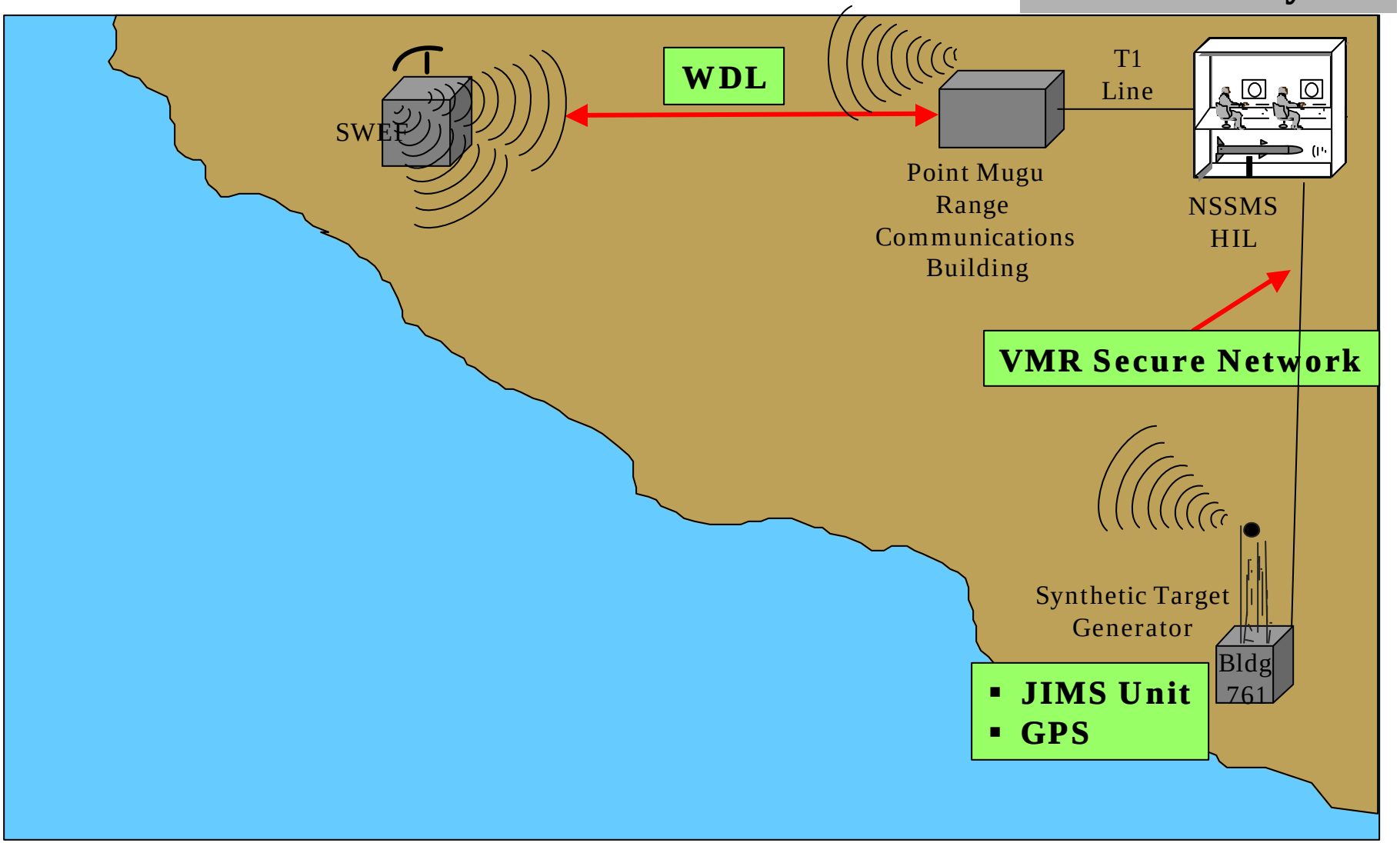
Synthetic Target Generator

Bldg 761

Simulation/Control

Land-Based T&E, Phase 3

Feb '00 - May '00

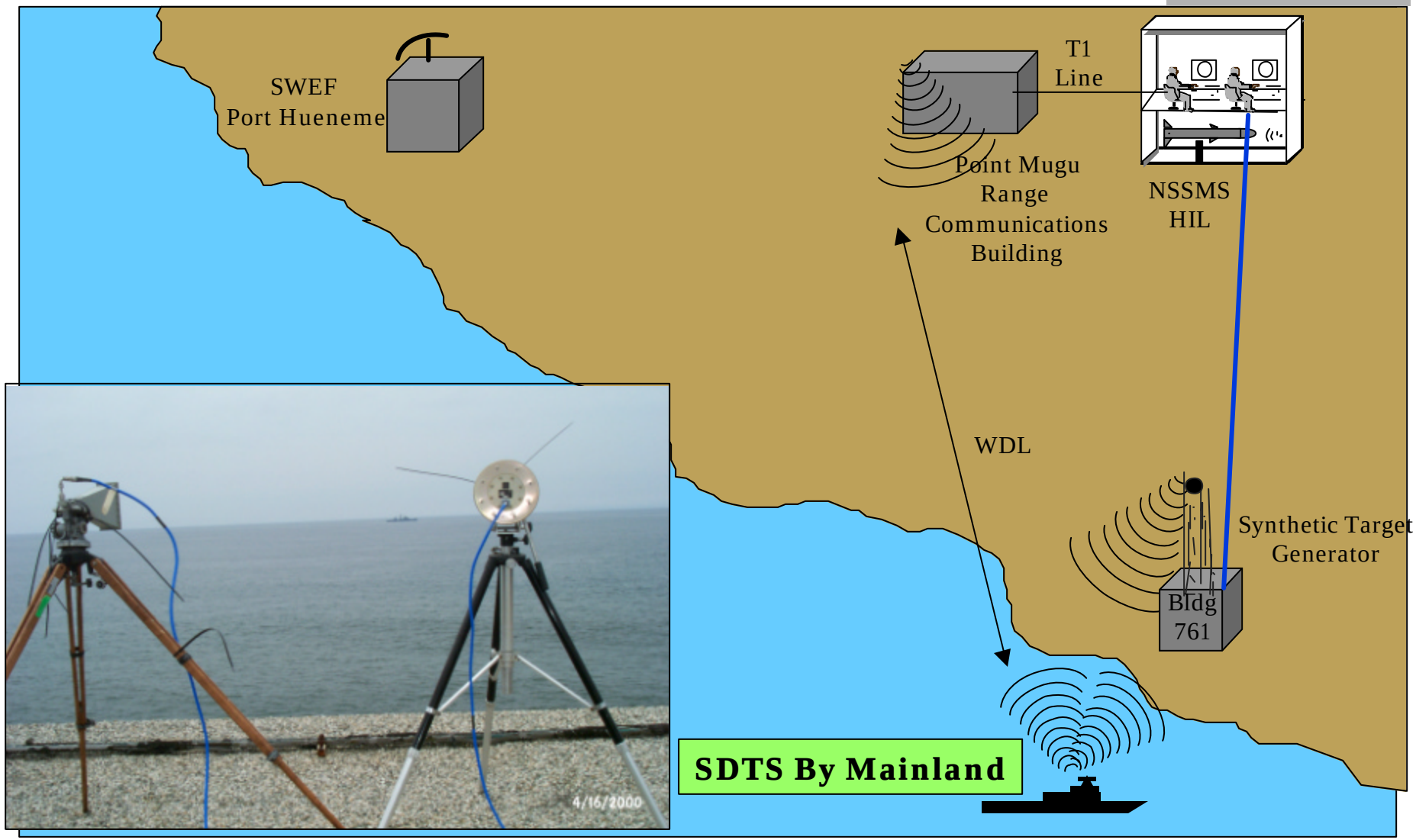


Ship Installs

- **Data Acquisition**
  - Synthetic Missile Interface Terminal H/W (SMITH) Unit
    - o Pre-Launch Signals
  - Break-Out Cables & Extensions
  - GPS Antenna
- **Wireless Data Link**
  - Base Station, Antenna, Crypto
  - 2.4 GHz From Ship To Island
- **Missile All-up Round Simulator (MARS)**
  - Simulates RIM-7P Missile Within Launcher

Sea-Based T&E, Phase 1

16 June '00



Moved to San Nicolas Island

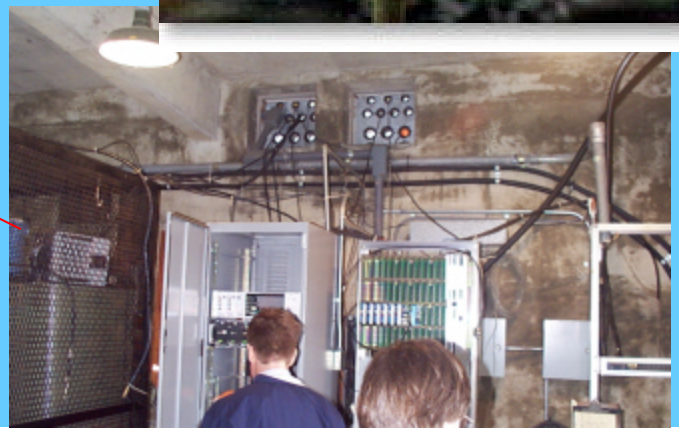
23 August '00

Synthetic Target Generators (STGs)

STG Radomes

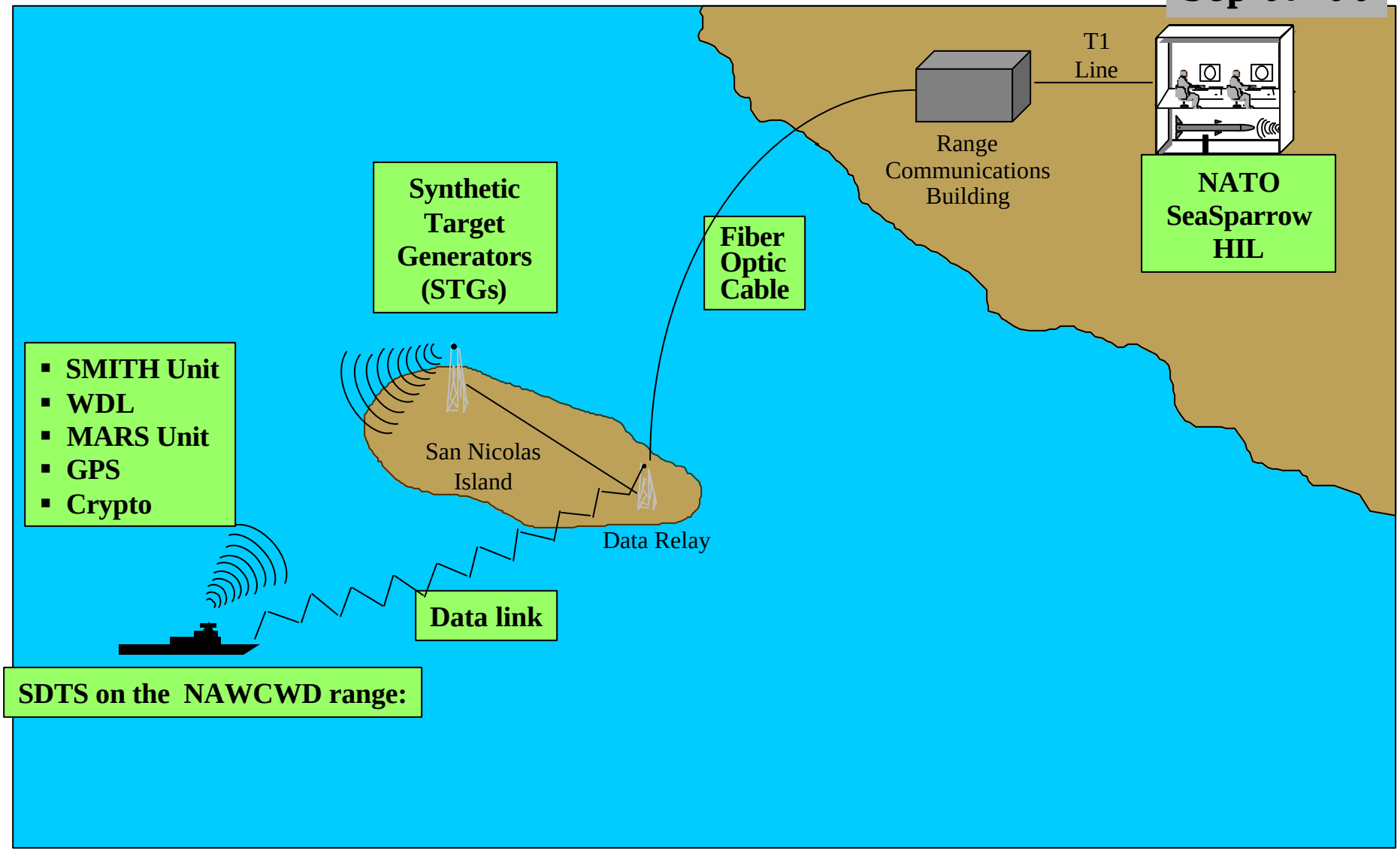
WDL Antenna

STG Electronics Room



Sea-Based T&E, Phase 2

Sep 07 '00



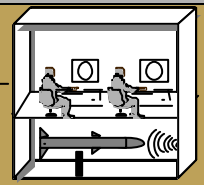
- SMITH Unit
- WDL
- MARS Unit
- GPS
- Crypto

USS Kinkaid Demonstration

Sep 12-13 '00

Interoperability Test and Evaluation Center (ITEC)

T1 Line



Range Communications Building

NATO SeaSparrow HIL

NSSM Firing Consoles

Synthetic Target Generators (STGs)

Fiber Optic Cable

San Nicolas Island

Data Relay

Data link

USS KINKAID
STEADFAST AND TRUE
DD-965

Results

12 Sept ‘00

- 49 Incoming Threats Presented
- 6 Different Start Ranges, Speeds, RCSs
- 3 Firing Crews Cycled Through Consoles

13 Sept ’00

- 37 Incoming Threats Presented
- 5 Different Start Ranges, Speeds, RCSs
- 6 Launches / 4 Kills

Summary

- **T&E Opportunities Conceived VMR Vision**
- **Progressive Land-Based T&E Led To Successful Sea-Based Operational Results**
- **Developed, T&Eed, And Demonstrated On Schedule And Within Budget**

Back-Up Slides

Operational Costs

1 Event = 2.5 hours (Estimated 25 shots)

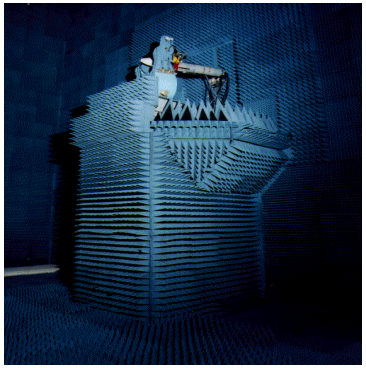
STG:	Included in range costs
HIL:	$8000/Event
Ship Installs:	$8000/Event
Range:	$4000/Event
2 Hr. Report:	$2000/Event
Event Coordination:	$8000/Event

TOTAL: $30,000/Event

(Based on 25 shot event) **$ 1,160/shot**

Live fire cost to taxpayer $451,800 / shot

Realm Of The VMR



Detect | **Assess & Designate** | **Engage** | **Missile Flyout**

- External Target Gen
- TAS
- NSSMS Fire Control

Other Training Systems

- 6DOF/HIL Simulation
- STG Dispersion
- End Game/Lethality

VMR

Live Fire Test

- Sticky Accelerator
- Fuse Activation
- Propulsion
- Many Other Electro/ Mechanical Entities

Next Steps

- **Electronic CounterMeasures**
  - Generic Jamming
  - Threat Replica Jamming
- **Additional Threat Presentations**
  - Multi Axis
  - Stream Raid
  - Manuvering
- **Additional Platforms**
  - CV
  - AO
- **Additional Missiles**
  - VL NSSM, ESSM, SM